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A NEW SPECIES OF BULLFINCH (AVES: EMBERIZINAE) FROM A LATE QUATERNARY CAVE DEPOSIT ON CAYMAN BRAC, WEST INDIES

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Abstract.—A new species of bullfinch, *Melopyrrha latirostris,* is described from latest Pleistocene to early Holocene cave deposits on Cayman Brac, West Indies. This species is larger in its cranial dimensions than other species of West Indian finches. *Melopyrrha latirostris* represents one of many species of vertebrates that is known on Cayman Brac only from fossils. Specimens referred to *M. nigra taylori,* which occurs today only on Grand Cayman, were recovered from the same stratigraphic levels as *M. latirostris.*

The Cayman Islands are three small islands in the Caribbean Sea, about halfway between Cuba and Jamaica (Fig. 1). In 1965, Dr. Thomas H. Patton, then of the University of Florida, excavated several deposits of fossiliferous sediment from limestone caves on Cayman Brac, the easternmost island. From the richest of these sites, known herein as Patton's Fissure, thousands of vertebrate fossils were recovered from deposits of presumed Holocene age. These fossils, reported first by Patton (1966), are discussed in detail by Morgan (in press).

Patton's Fissure is located in the village of Spot Bay, 3 km west of the northeast point of Cayman Brac at 19°45'N and 79°45'W. It is in the side of a cliff about 15 m above sea level and 250 m inland from the northern coast. Patton's Fissure is about 50 m long, a maximum of 4 m wide at the base, and trends east to west, parallel to the cliff face. A layer of unconsolidated sediments 1–2 m deep covers the entire fissure. These sediments consist of buff to reddish-colored silts and clays, angular limestone fragments, land snail shells, and bones of small vertebrates. Three holes were excavated in Patton's Fissure, one of which (Hole 1) produced a significant amount of bone. Hole 1 was approximately 2 m square by 1.6 m deep. The stratigraphy of Patton's Fissure is as follows: Layer 1 (0–20 cm) contains abundant bone, including both extinct endemic mammals as well as introduced species such as *Rattus* that indicate a post-Columbian age. Layers 2–4 (20–80 cm) are sparsely fossiliferous, but contained no introduced species or evidence of human occupation, thus indicating a pre-Columbian age for these and all deeper layers. Layers 5–7 (80–140 cm) are extremely rich in both land snail shells and bones of small vertebrates. Most of the bird fossils described in this paper, and the great majority of all vertebrate fossils from Cayman Brac, are from these three layers. Layers 8–9 (140–160 cm) contain few bones and many are either covered with a calcareous precipitate or are contained in an indurated breccia. Solid limestone was encountered below Layer 9.

Unfortunately, neither Patton's original field notes nor the results from several radiocarbon ages determined in the late 1960's for Patton's Fissure are available, although Patton (pers. comm.) refers the age of the lower levels of this site to the early Holocene. This age is reasonable based upon preservation of the fossils and

Fig. 1. The West Indian Islands.

upon comparisons with fossil faunas from other West Indian caves. Recently we dated three samples of land snails from Patton's Fissure, using the single-species methodology of radiocarbon age determination on land snails developed for Jamaican species (Goodfriend and Hood 1983; Goodfriend and Stipp 1983). Our samples of Caymanian snails (*Hemitrochus caymanensis*) should provide a fairly accurate estimate of the age of Patton's Fissure, for *H. caymanensis* is an arboreal snail that does not feed on the ground (F. G. Thompson, pers. comm.). Therefore, this species should incorporate little if any "dead carbon" into its shell through ingestion of limestone. The age determinations are (in years BP, with lab number): 11,180 ± 105 (Layer 5, SI-6518); 13,230 ± 135 (Layer 7, SI-6519); and 13,850 ± 135 (Layer 9, SI-6520). These concordant results represent maximum ages, depending upon the level at which the dated snails had incorporated environmental carbonate into their shells during life. The radiocarbon data suggest an age of latest Pleistocene or earliest Holocene for the fauna from Layers 5–9 of Patton's Fissure.

The fauna from Patton's Fissure includes the extinct capromyid rodents *Capromys* and *Geocapromys* and the insectivore *Nesophontes,* as well as several living species of bats that no longer occur on Cayman Brac. Based upon Minimum Number of Individuals, lizards dominate the fauna of Patton's Fissure (67%), followed by mammals (25%, most of which are *Nesophontes*), and birds (8%, not including unidentified passerines).

The avian fossils from Patton's Fissure are mainly of small passerines that remain incompletely studied. Conspicuous among these passerine fossils are numerous cranial elements of a finch that is much larger than *Tiaris olivacea,* the only emberizine known historically from Cayman Brac. We describe these fossils as representing two sympatric forms of *Melopyrrha,* of which one is extinct and the other survives only on Grand Cayman, a larger island 130 km west of Cayman Brac.

Systematic Paleontology

Class Aves
Order Passeriformes
Family Fringillidae
Subfamily Emberizinae
Genus *Melopyrrha*

In possessing the following characters, the series of fossils from Patton's Fissure may be referred to *Melopyrrha* rather than to the closely related West Indian emberizine genera *Tiaris, Loxipasser, Loxigilla, Euneornis,* or *Melanospiza.* (Descriptive terminology follows Baumel et al. 1979; fossil specimens are deposited in the Vertebrate Paleontology Collections of the Florida State Museum [UF], while modern skeletal specimens are from the National Museum of Natural History, Smithsonian Institution [USNM].

Maxilla.—In lateral aspect, more arched (curved) along both the dorsal and ventral surfaces (most closely approached by *Loxipasser*); relatively broad medial bar of Os nasale; presence of a small but distinct foramen in medial portion of the lateral bar of Os nasale, near the dorsal margin of the nares; relatively much shorter and stouter than in *Euneornis campestris* or *Melanospiza richardsoni.*

Mandible.—In dorsal aspect, distal end of pars symphysialis less pointed; in lateral aspect, dorsal surface of dentary more curved than in all except *Tiaris bicolor* and *Loxipasser anoxanthus*; mandibular foramen relatively small; overall much stouter and more "finch-like" than in *Euneornis campestris.*

Quadrate.—Except for differences in size, it is difficult or impossible to distinguish individual quadrates among the six closely related genera of West Indies finches mentioned above. The fossil quadrates from Cayman Brac differ from those of the only other similarly-sized nine-primaried oscine in the fossil deposit (the tanager *Spindalis zena*; Thraupinae) in forming an obtuse angle in lateral aspect between the processus quadratojugalis and condylus squamosus, this angle being more nearly 90° in *Spindalis.*

In describing *Melopyrrha taylori* from Grand Cayman, Hartert (1896) doubted the distinctness of *Melopyrrha* from other (unspecified) genera of finches. Standard check-lists (i.e., Bond 1956, Paynter 1970, AOU 1983) recognize all six of the emberizine genera discussed above, although we believe that most or all of these genera can be accommodated in an expanded genus *Tiaris* Swainson, 1827, on the basis of plumage and osteology. These finches represent an unrecognized evolutionary radiation within the West Indies, in many ways comparable to that of emberizines in the Galapagos Islands. This West Indian emberizine radiation and its systematic ramifications have not yet been fully documented, so we will describe the new species from Cayman Brac in the genus *Melopyrrha* rather than in *Tiaris.*

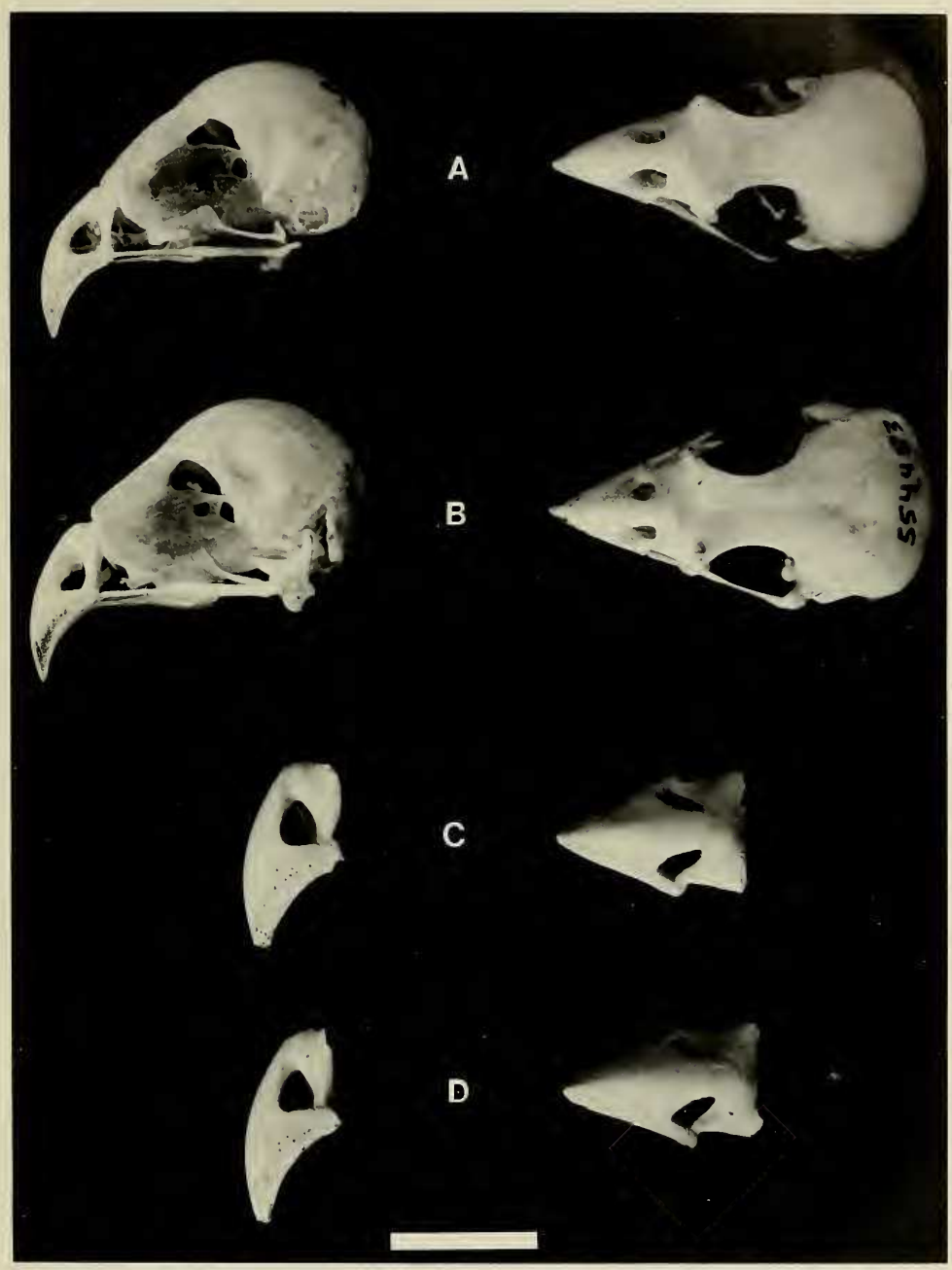

Fig. 2. Maxillae and skulls of fossil and modern *Melopyrrha.* Lateral aspect in left column, dorsal aspect in right column. A, *M. nigra nigra* male, USNM 321962, Cuba; B, *M. n. taylori* male, USNM 554483, Grand Cayman; C, *M. latirostris,* holotype, UF 23011, Cayman Brac; D, *M. latirostris,* paratype, UF 61022, Cayman Brac. Scale bar = 1 cm.

Melopyrrha latirostris, new species
Figs. 2, 3

Holotype.—Complete maxilla, UF 23011, from Hole 1, Layer 7 of Patton's Fissure, Spot Bay, Cayman Brac, Cayman Islands. Collected by T. H. Patton during the summer of 1965 (exact date unknown).

Paratypes.—All from Hole 1, Layer 7 of Patton's Fissure. 12 complete or nearly complete quadrates, UF 61008–61019; 9 complete or partial maxillae, UF 61020–61028; 13 incomplete mandibles, UF 23012, 61029–61042.

Referred material.—All from Hole 1 of Patton's Fissure. Layer 2—partial maxilla, UF 23016. Layer 4—partial maxilla, UF 23015. Layer 5—complete or nearly complete quadrates, UF 61001, 61003, 61005. Layer 6—partial mandible, UF 23013.

Diagnosis.—Larger than *Melopyrrha nigra,* especially in width of maxilla and height of mandible (Table 1, measurements A, B, D, F, G). Nares relatively small compared to size of entire maxilla. In lateral aspect, ventral surface of mandible nearly straight (*M. nigra* with a distinctly obtuse angle at junction of Os surangulare and Os dentale). In lateral aspect, dorsal surface of Os dentale relatively straight. Os dentale proportionately long relative to length of entire mandible.

Etymology.—From the Latin *latus,* broad, and *rostrum,* bill or snout. The name *latirostris* is regarded as a noun in apposition.

Discussion

Evolution.—*Melopyrrha nigra,* the only living species in the genus, occurs today on Cuba and the Isle of Pines (*M. n. nigra*) and Grand Cayman (*M. n. taylori*). *Melopyrrha latirostris* is much closer in size to *M. n. taylori* than to *M. n. nigra* (Table 1), and on this basis it is likely that *M. latirostris* evolved from a population of *M. n. taylori* or its immediate progenitor that became isolated on Cayman Brac. Nevertheless, several of the fossils from Hole 1 of Patton's Fissure are much too small to be referred to *M. latirostris* and are similar in size to modern specimens of *M. n. taylori* (Table 1). These smaller specimens, which we refer to *M. n. taylori,* include a mandible (UF 61045) from Layer 5, and a mandible (UF 61043) and a quadrate (UF 61006) from Layer 6. From these same layers are six other specimens that are intermediate in size between *M. latirostris* and *M. n. taylori* (a maxilla [UF 23014], a mandible [UF 61046], and two quadrates [UF 61002, 61004] from Layer 5, and a mandible [UF 61044] and quadrate [UF 61007] from Layer 6). We cannot say with certainty whether these last specimens represent very small female individuals of *M. latirostris,* or very large male individuals of *M. n. taylori,* or hybrids between the two species.

No specimens of *M. n. taylori* were recovered from Layer 7, the most fossiliferous layer collected. This fact suggests that *M. latirostris* was already established on Cayman Brac before *M. n. taylori* colonized (or re-colonized) the island. The intermediate specimens suggest that genetic interchange may have occurred between *M. latirostris* and *M. n. taylori* at that time, and the two specimens of *M. latirostris* from Layers 2 and 4 suggest that this species may have outlived its congener, only to disappear as well sometime in the Holocene. We regard *M. latirostris* as a full species rather than a subspecies of *M. nigra* because of its

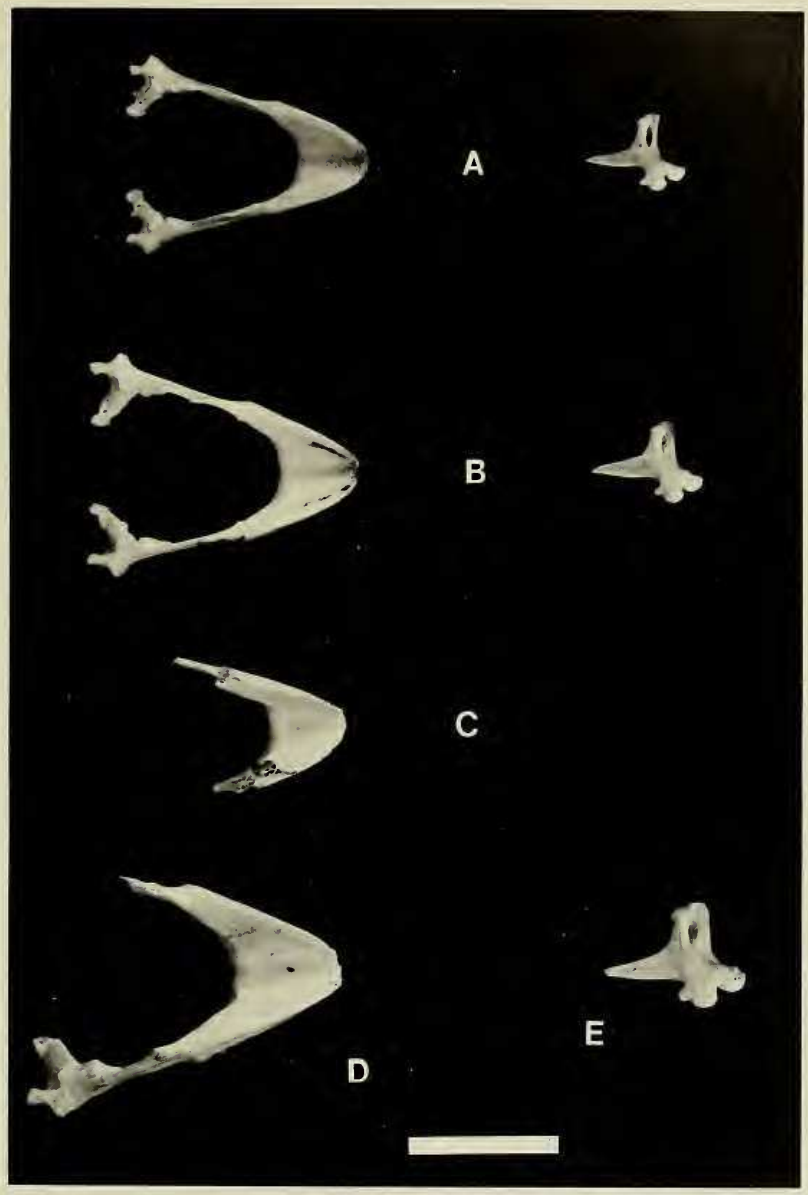

Fig. 3. Mandibles and quadrates of fossil and modern *Melopyrrha.* Dorsal aspect of mandibles in left column, lateral aspect of quadrate in right column. A, *M. nigra nigra* male, USNM 321962, Cuba; B, *M. n. taylori* male, USNM 554483, Grand Cayman; C, *M. n. taylori-M. latirostris* intermediate fossil, UF 61046, Cayman Brac; D, *M. latirostris* paratype, UF 23012, Cayman Brac; E, *M. latirostris* paratype, UF 61008, Cayman Brac. Scale bar = 1 cm.

sympatry with *M. n. taylori* and because of its very large size; it is larger relative to *M. n. taylori* than the latter is to *M. n. nigra* (see ratios in Table 1).

The maxilla, quadrate, and mandible of *M. latirostris* are broader and more massive than in other West Indian finches. All or nearly all of the diagnostic

Table 1.—Measurements (in mm) of fossil and modern *Melopyrrha,* giving mean, sample size (in parentheses), and range. UF catalogue numbers are given in parentheses for individual fossils referred either to *M. nigra taylori* or to *M. n. taylori-M. latirostris* intermediates.

	A Maxilla: minimum width of medial bar of Os nasale	B Maxilla: minimum width of lateral bar of Os nasale	C Maxilla: length from nares to tip of Os premaxillare
M. nigra nigra	1.3 (7)	0.5 (8)	6.1 (7)
Cuba, males	1.1–1.7	0.4–0.7	5.8–6.5
M. n. taylori	1.7 (7)	0.6 (8)	7.0 (8)
Grand Cayman, males	1.5–1.9	0.5–0.8	6.7–7.4
M. n. nigra	1.4 (2)	0.6 (2)	5.8 (2)
Cuba, females	1.2–1.6	0.6	5.7–5.9
M. n. taylori	1.5 (5)	0.6 (5)	6.5 (5)
Grand Cayman, females	1.4–1.7	0.5–0.6	6.3–6.7
M. latirostris	2.5 (10)	1.2 (9)	8.2+ (3)
	2.2–2.8	1.1–1.5	8.0+–8.4+
M. n. taylori fossils, Cayman Brac	—	—	—
Intermediate fossils, Cayman Brac	2.1 (UF 23014)	0.9 (UF 23014)	7.0+ (UF 23014)
Ratio of mean in *M. n. nigra* to that in *M. n. taylori* (males)	0.76	0.83	0.87
Ratio of mean in *M. n. taylori* males to mean in *M. latirostris*	0.68	0.50	0.86 or less

"+" after a value for certain fossil specimens means that the measurement of a slightly damaged specimen approaches to within 0.4 mm or less the actual value of the measurement if the specimen had been undamaged.

characters of *M. latirostris* are associated allometrically with its large size. The large, rounded maxilla of *M. latirostris* is reminiscent of that found in *Geospiza crassirostris,* a frugivorous emberizine finch from the Galapagos. The maxilla of *M. latirostris,* is more powerfully built than that of *G. crassirostris,* especially in the nasal region, so *M. latirostris* may have subsisted on a mixed diet of fruit and seeds. Alternatively, *M. latirostris* may have been mainly a seed-eater, for its larger bill would have permitted it to take a variety of seeds. Further speculation on the feeding habits of *M. latirostris* awaits better documentation of the feeding habits of living *M. nigra.* The only report we have found on this topic is Johnston's (1975:300) for *M. n. taylori* of Grand Cayman, where insects and unidentified seeds were found in the stomachs of four different birds.

Zoogeography.—The two species of *Melopyrrha* from Cayman Brac are most closely related to *M. n. nigra* from Cuba, reflecting the dominant zoogeographic pattern seen in the extinct and living vertebrate fauna from the island. In the combined vertebrate fauna from five cave deposits excavated on Cayman Brac, 17 (81%) of the 21 species of known zoogeographic affinities are conspecific with or are derived from Cuban species, whereas the remaining four species have Jamaican affinities (Morgan, in press). Several physical and biological factors favor Cuba over Jamaica as a source area for most of the vertebrate fauna of Cayman Brac. These include: the considerably larger area, and longer coastline of Cuba;

Table 1.—Extended.

D Maxilla: maximum width	E Mandible: total length	F Mandible: maximum height of Os sur-angulare	G Mandible: height at junction of Os dentale and Os surangulare	H Mandible: maximum width of entire Os dentale	I Mandible: length of cotyla lateralis	J Quadrate: total height
5.6 (8)	18.2 (5)	3.9 (7)	2.7 (8)	8.0 (7)	2.2 (8)	5.2 (7)
5.0–6.1	17.4–18.6	3.5–4.4	2.3–3.1	7.8–8.5	2.1–2.4	5.0–5.3
6.3 (7)	19.6 (5)	5.0 (8)	3.4 (8)	9.5 (6)	2.6 (8)	5.6 (8)
6.1–6.6	19.2–20.1	4.5–5.3	3.2–3.6	9.2–9.9	2.4–2.7	5.5–5.9
5.5 (2)	17.2 (2)	3.8 (2)	2.4 (2)	7.4 (2)	2.0 (2)	5.0 (2)
5.4–5.6	17.1–17.3	3.8–3.9	2.4	7.3–7.5	2.0	4.9–5.2
5.8 (5)	18.6 (2)	4.4 (4)	3.1 (4)	8.5 (3)	2.4 (5)	5.4 (4)
5.7–5.9	18.3–18.9	4.3–4.5	2.9–3.2	8.2–8.7	2.2–2.6	5.3–5.5
8.3+ (8)	23.4 (1)	6.5 (2)	4.7 (8)	11.4 (8)	3.0 (4)	7.1 (15)
7.6+–8.8	23.4	6.4–6.6	4.1–5.0	10.3–12.3	2.8–3.2	6.6–7.5
—	—	—	3.1 (UF 61043) 3.2 (UF 61045)	8.7 (UF 61045)	—	6.1 (UF 61006)
7.0+ (UF 23014)	—	—	3.8 (UF 61044) 3.9 (UF 61046)	—	—	6.4 (UF 61002, 61004, 61007)
0.89	0.93	0.78	0.79	0.84	0.85	0.93
0.76 or less	0.84	0.77	0.76	0.83	0.87	0.79

the closer proximity of Cuba to the Cayman Islands during Pleistocene glacial intervals; Cuba's greater species diversity; and, today's prevailing currents favor overwater dispersal from Cuba rather than Jamaica. Cayman Brac is almost equidistant (200 km) from Cuba to the east and northeast and from Jamaica to the southeast, and is separated from both islands by oceanic depths in excess of 1000 m, eliminating the possibility of land bridges during the late Tertiary. However, during periods of lower sea level in Pleistocene glacial intervals, Cuba would have extended to within 100 km of Cayman Brac as the extensive carbonate bank areas along its southern coast became exposed. The lack of evidence for a land connection leaves overwater dispersal as the only means by which Cayman Brac could have received its vertebrate fauna. Based on the low percentage of endemic species and the absence of generic level endemism on Cayman Brac, we believe that the majority of the fauna arrived during the Pleistocene.

Extinction.—Forty species of vertebrates have been identified from Holocene cave deposits on Cayman Brac (8 species of reptiles, 23 of birds, and 9 of mammals), the great majority of which are from Hole 1 of Patton's Fissure (Morgan, in press). Of these 40 species, 17 (11 species of birds and 6 of mammals) no longer occur on Cayman Brac. Of these 17 species, six are still found on Grand Cayman, seven no longer occur in the Cayman Islands but exist elsewhere in the West Indies, and four (including *Melopyrrha latirostris*) are extinct species known only

from the Cayman Islands. The stratigraphy and chronology of the five caves excavated on Cayman Brac are not known well enough to determine precisely when the majority of these 17 species disappeared from the island. Fossils of all six species of mammals now extinct on Cayman Brac have been collected in caves from surface remains that are believed to be less than 500 years old based upon the presence of *Rattus.* On the other hand, only one of the 11 extirpated species of birds, *Puffinus lherminieri,* has been recovered from these same surface layers, while the remaining 10 species are known only from the pre-Columbian strata in Hole 1 of Patton's Fissure. From the data available, we cannot determine whether these 10 species, which include both species of *Melopyrrha,* disappeared from natural causes before AD 1500 or were extirpated as a result of extensive habitat disturbance by post-Columbian peoples.

There is no evidence of aboriginal occupation of any of the Cayman Islands (Hirst 1910; Richards 1955), so all Holocene habitat alteration can be attributed to post-Columbian settlers. Thus it is conceivable that the extinction of either or both forms of *Melopyrrha* on Cayman Brac was an historic event, but we need a refinement of the chronology of the upper sediments at Patton's Fissure or other fossil sites before the chronology of extinction of *Melopyrrha* on Cayman Brac can be resolved beyond "probably late Holocene." Nevertheless, the stratigraphic evidence suggests that *M. latirostris* may have swamped out *M. n. taylori* through interbreeding.

That two congeneric finches could co-inhabit an island as small as Cayman Brac is not extraordinary, for until recently a parallel situation existed on St. Kitts in the Lesser Antilles. Two species of bullfinches, *Loxigilla noctis* and *L. portoricensis grandis,* occurred on St. Kitts until several decades ago when *L. p. grandis* apparently became extinct (Olson 1984). St. Kitts is not much larger than Cayman Brac in area, but is much higher in elevation, supporting lush forest in the volcanic highlands. However, Olson points out that *L. p. grandis* may have evolved in the lowlands of St. Kitts, so habitat diversity may have played little if any role in permitting the two species of *Loxigilla* to co-exist on St. Kitts. Although the limestone forest of Cayman Brac has a low canopy height and a low species diversity today, birds elsewhere in the West Indies tend to be relatively abundant in both absolute numbers and numbers of species in arid habitats (Kepler and Kepler 1970; Pregill and Olson 1981). Thus we see no reason why the prehistoric forests of Cayman Brac could not have supported two or more species of congeneric finches.

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